7. Circuit Operating Descriptions

7-1 Power

7-1-1 Comparsion between Linear Power Supply and S.M.P.S.

7-1-1 (a) Linear

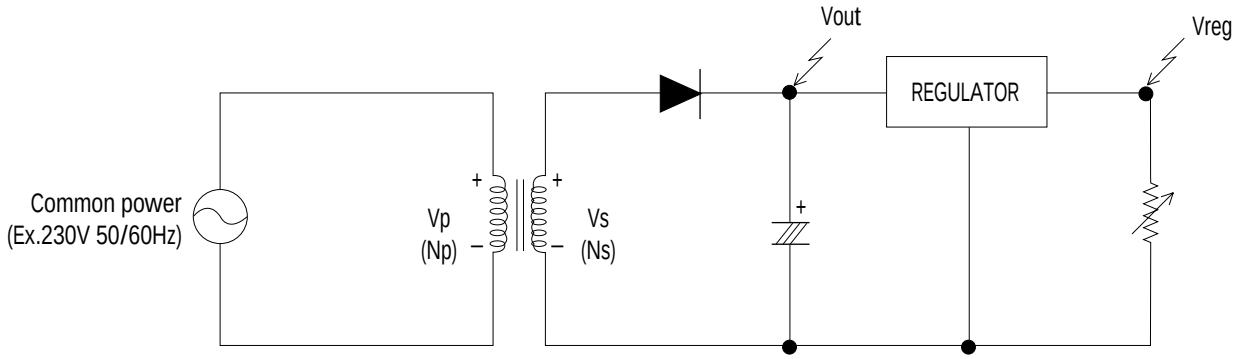

Fig. 7-1 Linear Power Supply

◆ Waveform/Description

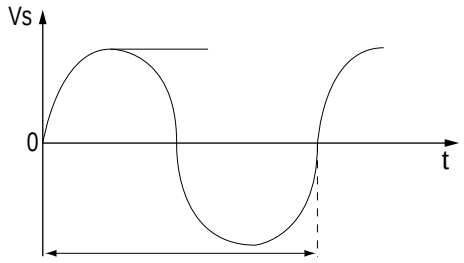

Fig. 7-2

Input : Common power to transformer (Vp).

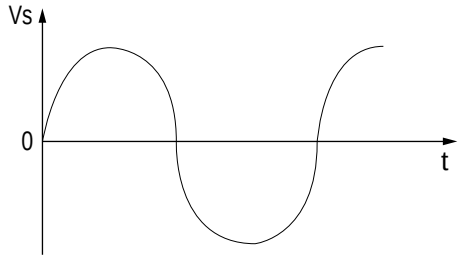

Fig. 7-3

The output Vs of transformer is determined by the ratio of 1st Np and 2nd Ns.
Vs = (Ns / Np) x Vp

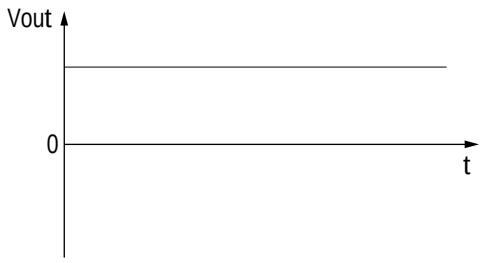

Fig. 7-4

Vout is output (DC) by diode and condensor.

◆ Advantages and disadvantages of linear power supply

1) Advantages : Little noise because the output waveform of transformer is sine wave.

2) Disadvantages :

❶ Additional margin is required because Vs is changed (depending on power source). (The regulator loss is caused by margin design).

❷ Greater core size and condensor capacity are needed, because the transformer works on a single power frequency.

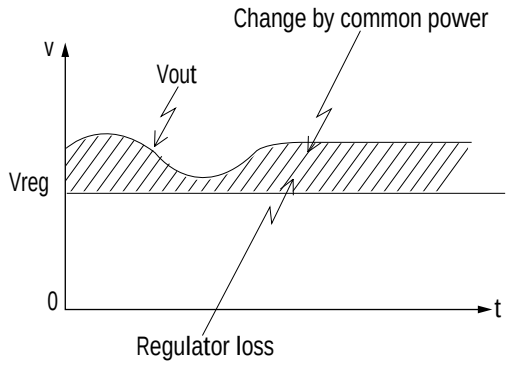

Fig. 7-5

3-3-1 (b) S.M.P.S. (Pulse width modulation method)

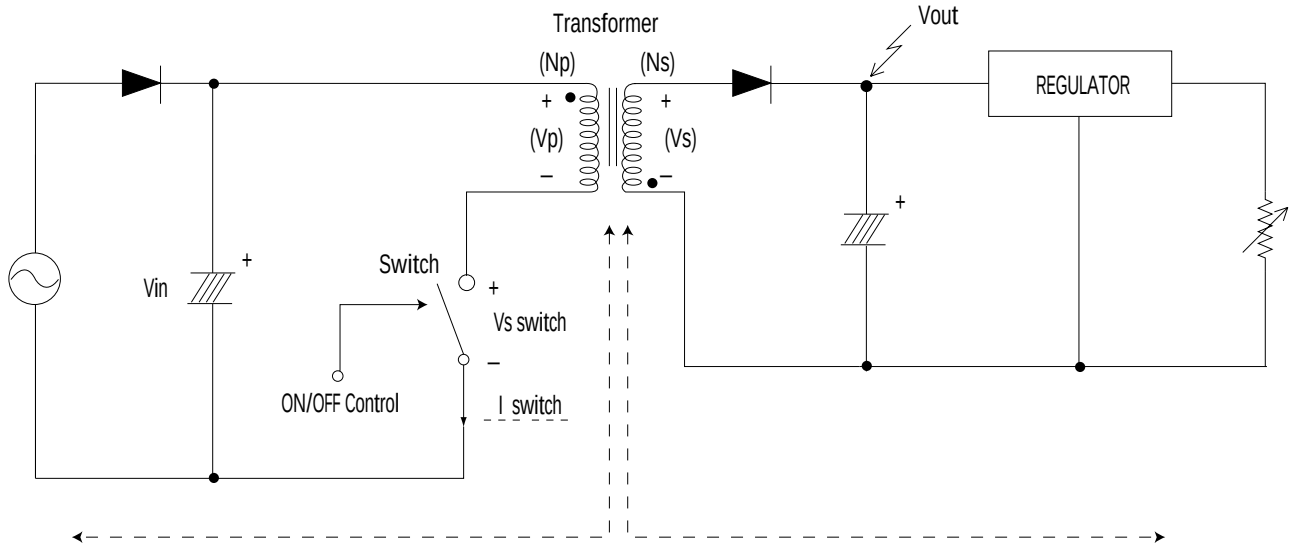

Fig. 7-6

◆ Terms

1) 1st : Common power input to 1st winding.
2) 2nd : Circuit followings output winding of transformer.
3) f (Frequency) : Switching frequency (T : Switching cycle)
4) Duty : (Ton / T) x 100

7-1-2 Circuit description (FLY-Back Control)

7-1-2 (a) AC Power Rectification/Smoothing Terminal

1) PDS01, PDS02, PDS03, PDS04 : Convert AC power to DC(Wave rectification).
2) PER10 or PEF10 : Smooth the voltage converted to DC.
3) PCD01, PLF01, PCS03, PCD02, PCD03, PLS01, PBS01, PCF01, PCF02 : Noise removal at power input/output.
4) PVA1 : SMPS protection at power surge input (PVA1 pattern open is to remove noise).

7-1-2 (b) SNUBBER Circuit : PCD11, PCD12, PR1, PDS11

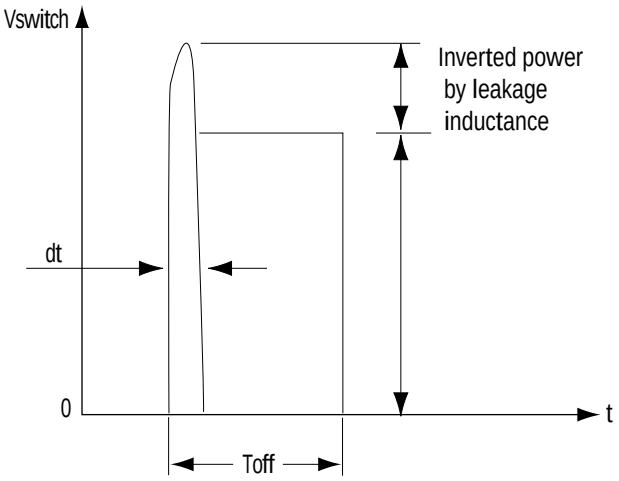

Fig. 7-7

1) Prevent residual high voltage at the terminals of switch during switch off/Suppress noise.
High inverted power occurs at switch (PIC1) off, because of the 1st winding of transformer :
(V= LI xdi/dt. LI : Leakage Induction)
A very high residual voltage exists on both terminals of PQR11 because dt is a very short.

2) SNUBBER circuit protects PIC1 from damage through leakage voltage suppression by RC, (Charges the leakage voltage to PER11, PDS11, PCD11 and discharges to PR1).

7-1-2 (c) Driving circuit

When Vin supplied, driving current Ig occurs throuhg the PRR11. By this IC (=HfexIg) occurs throug the PQR11 and the Vb is inducted to base winding coil NB of PQR11. By inducted Vb, Ib start flow and the PQR11 is saturated (S/W ON). Ib is constant and Ic increases in propotion to time. After constant time passed Ib become to shotage and PQR11 is cut OFF (S/W OFF).

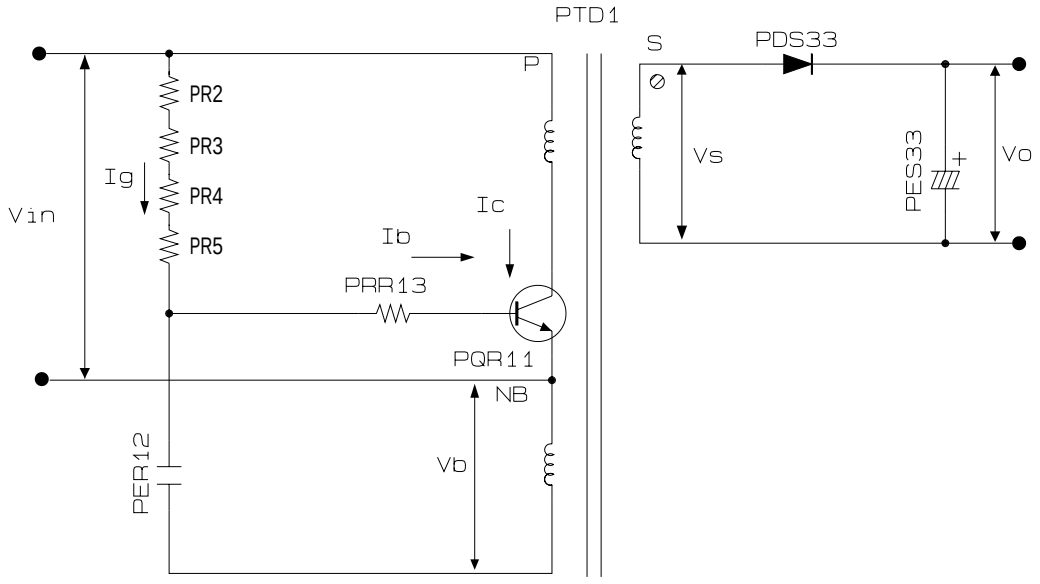

Fig. 7-8 Driving Circuit

7-1-2 (d) Feedback Control Circuit

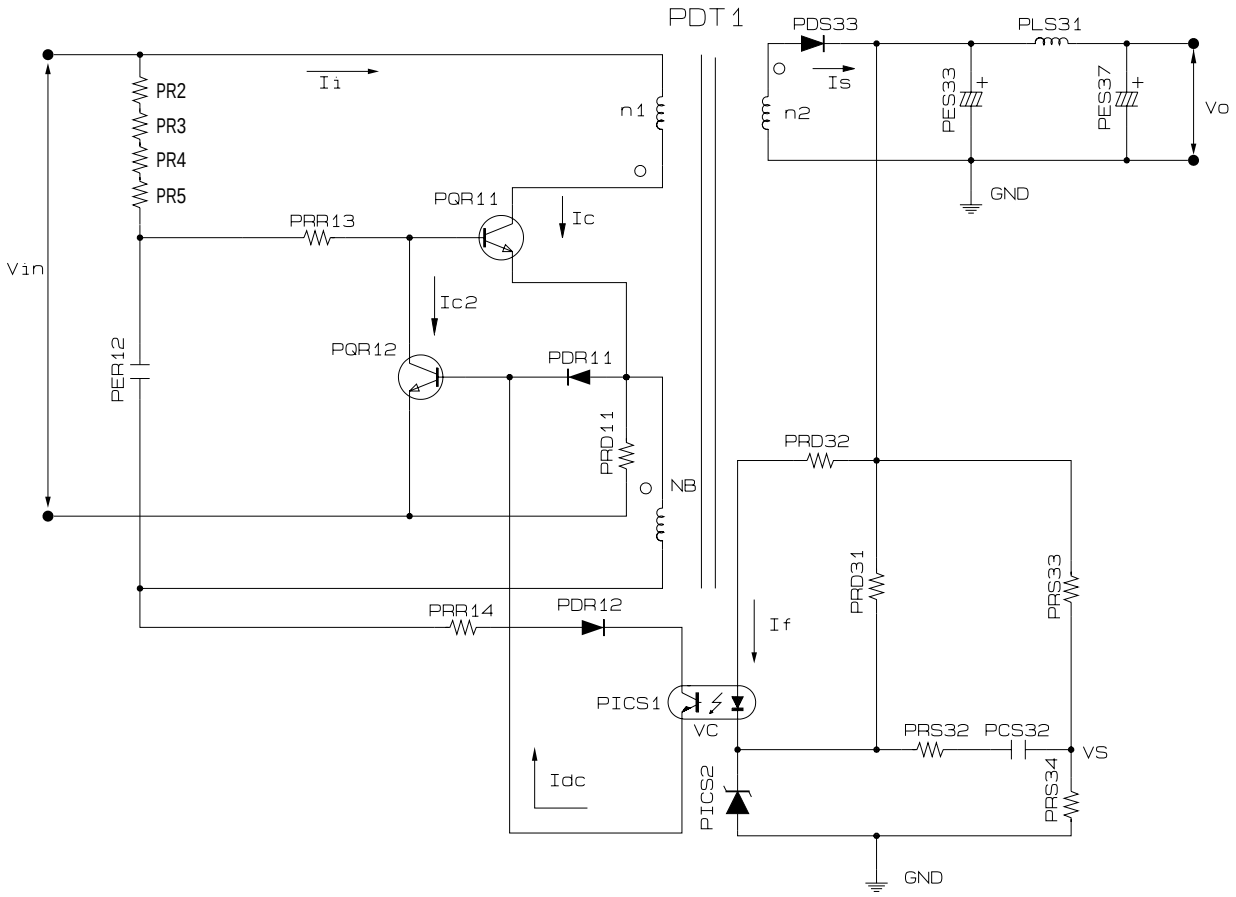

Fig. 7-9

◆ Operation descriptions

1) Internal OP-Amp '+' base potential of PICS2 is 2.5V and external "-" input potential is connected with PRS33 and PRS34 to maintain Vout of 5.8V.
2) If load of 5.8V terminal decreses (or AC inout voltage increases) and Vout increases over 5.8V,
   Then : PICS2 Vs potential up over 2.5V --> PICS2 Vc down --> PICS1 A-K potential down --> PICS1 C-E current up --> PQR12 base current up --> PQR11 base current down --> Vout down --> Maintain 5.8V

   - PRD31, PRD32 : Reduce 5.8V overshoot.
   - PRS32, PCS32 : Prevent PICS2 oscillation (for phase correction).

7-1-3 Internal Block Diagram

◆ Internal Block Diagram

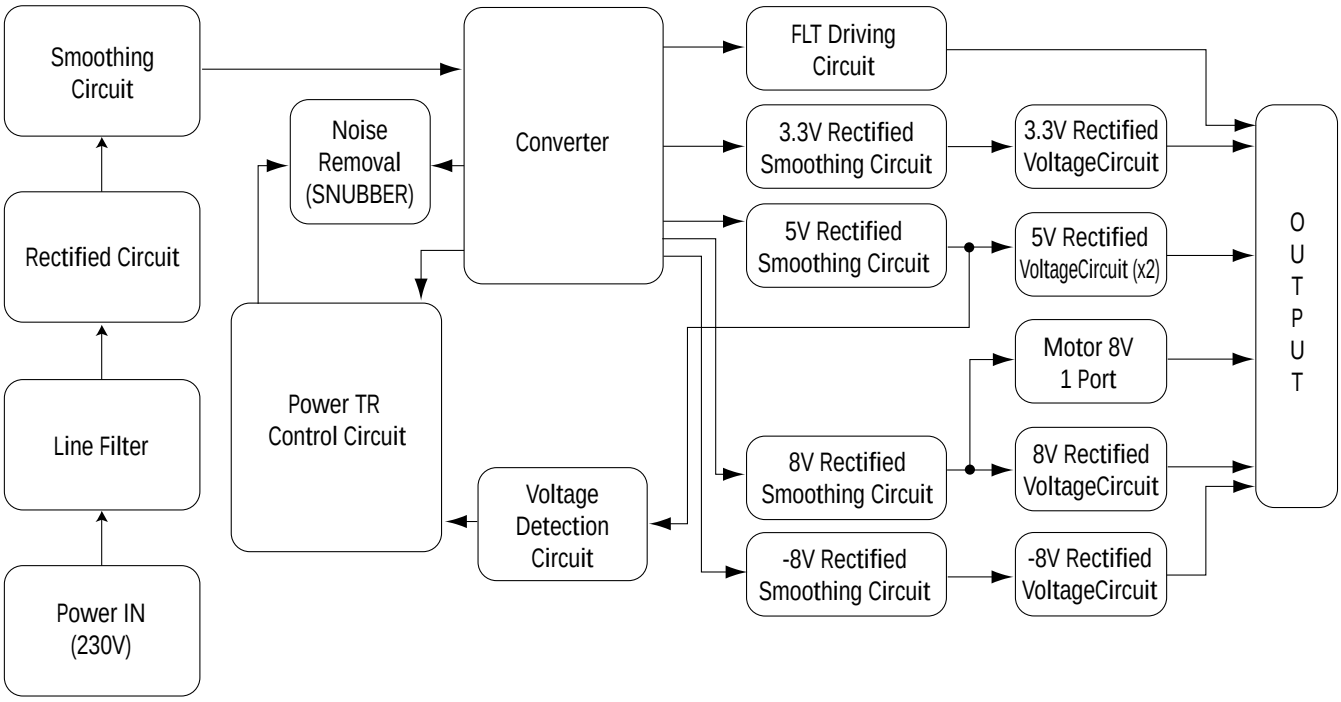

Fig. 7-10

7-2 RF

7-2-1 RIC1 (KS1463)

KS1463 is combined with KS1455 as bipolar IC developed for DVD SERVO system.
Main features include DVD waveform equalizing, CD waveform equalizing, focus error signal generation, 3-beam tracking error signal generation, DPD 1-beam tracking error, defect, envelope, MIRR output, Laser Power Control, etc.

7-2-1 (a) Basic Potentiometer

S5L1463 Uses 5V / 3.3V and reference voltage is 2.5V.
V (Pin 19, 32, 45, 49, 58-) terminal is needed for IC, which uses the peripheral V.

7-2-1(b) RF signal

Fig. 7-11 shows the flow of signal generated by the pick-up.
A, B, C, D signals detected from pick-up are converted in to RF signal(A+B+C+D) via RF summing AMP.

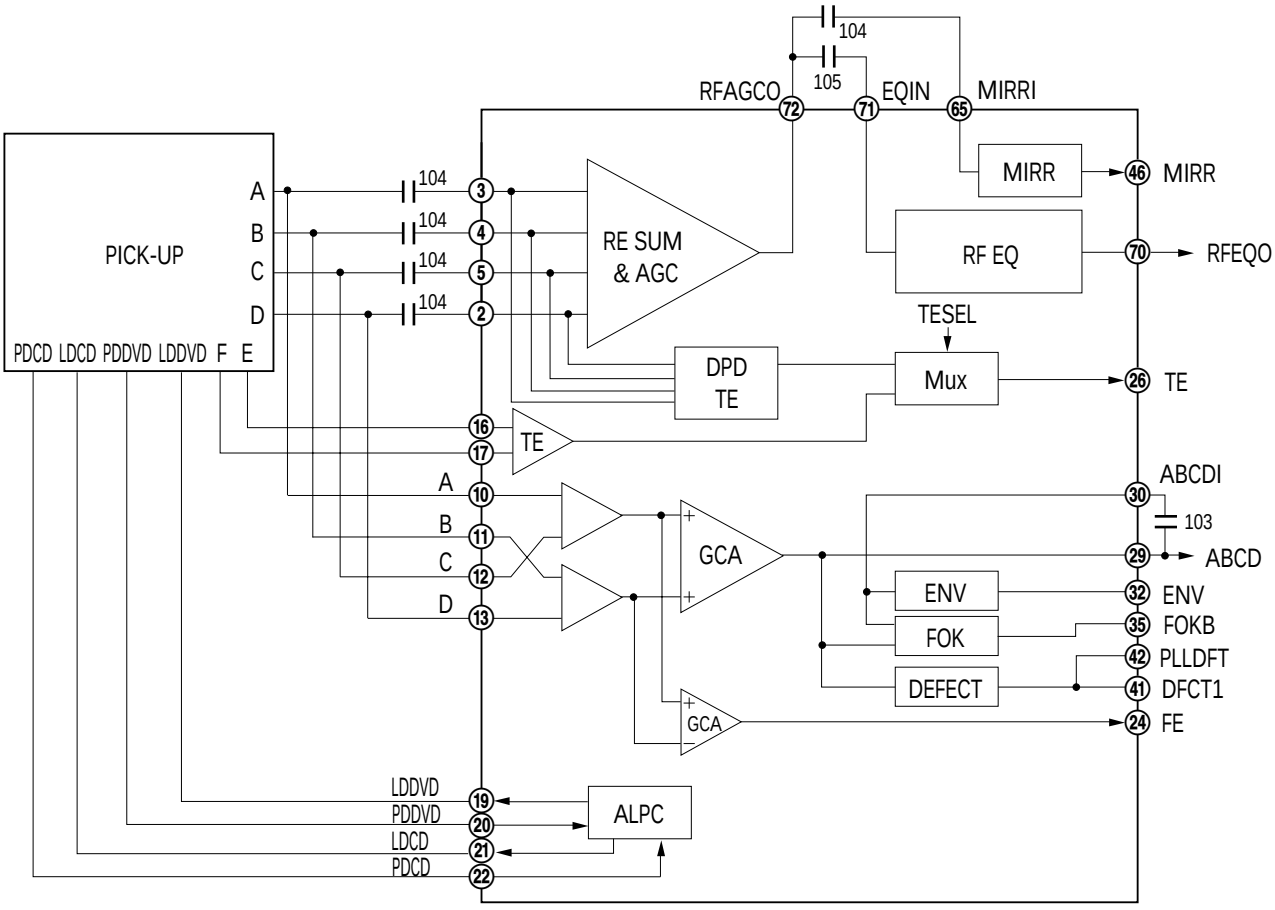

Fig. 7-11

Fig. 7-12 shows the waveform-equalizing block diagram for the RF signal.
It outputs to EQout (Pin 70) terminal by initially changing switching AMP gain of DVD and CD, and then adjusting the level in RF SUM & AGC.
RF SUM and AGC is Contvolled by PWM Signal and pin 78~80.
EQout Pin is Connected EQin.

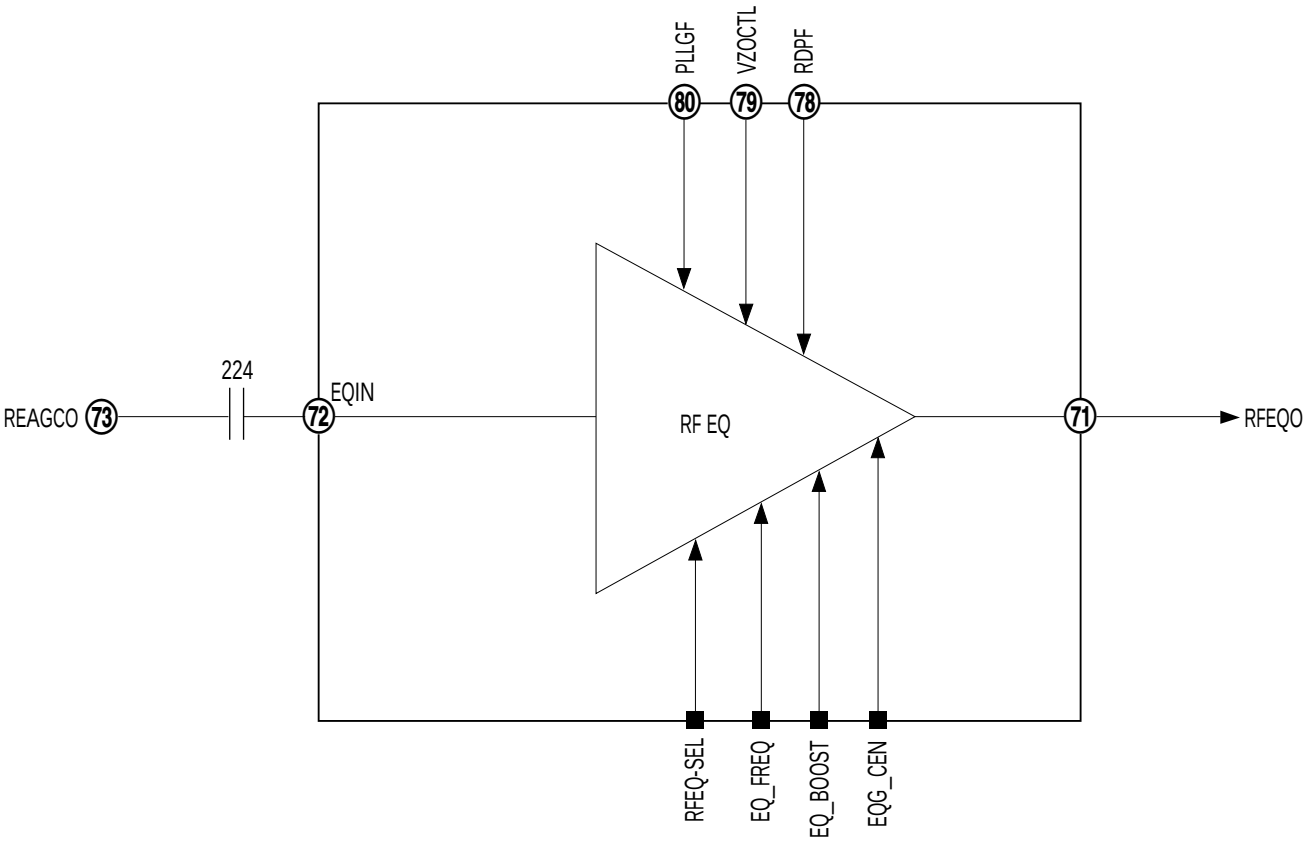

Fig. 7-12

The control parameters of DVD EQ and CD EQ are as follows.

1) DVD CD EQ control parameter

❶ EQG : Changes the gain of peak frequency with EQ frequency characteristic.

❷ EQF : Changes the peak frequency with EQ frequency characteristic.

7-3 System Control

7-3-1 Outline

The main micom peripheral circuit is composed of 8M EPROM (MIC2 ; 27C080) for Microcode and data save, 2Kbit EE-PROM (ZIC7) for permanent storage of data needed at power off, 64Mbit SDRAM (ZIC2) for temporary data read and write.
The Micom (ZIC1, Vaddis 5E) mounted in main board analizes the key commands of front panel or instructions of remote control through communication with Micom (FIC1 ; GMS81C2020) of front and controls the devices on board to execute the corresponding commands after initializing the devices connected with micom on board at power on.

7-3-2 Block Diagram

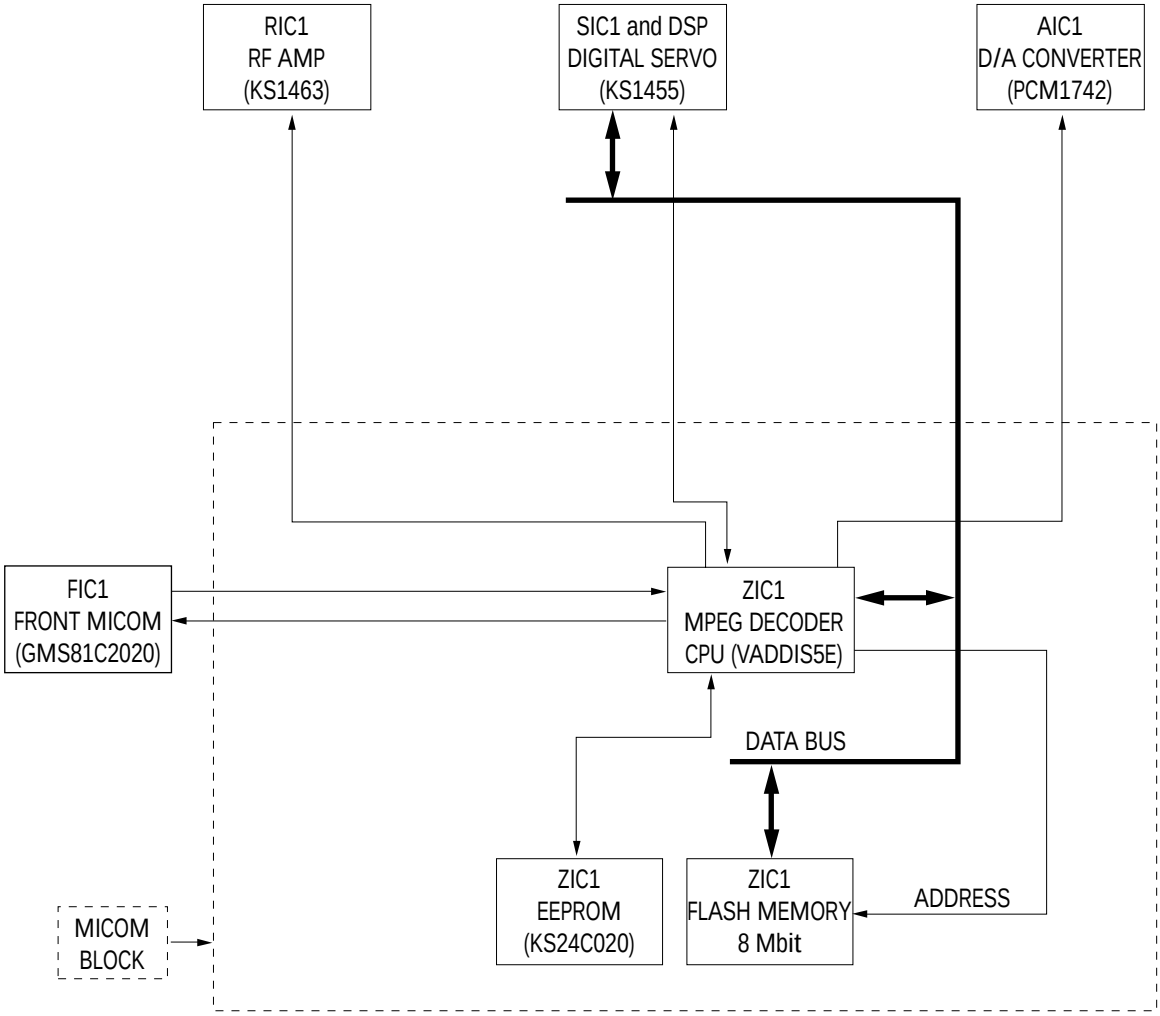

Fig. 7-13

7-3-3 Waveform Description

When micom accesses each device sharing bus, it falls the chip select signal of corresponding chip to (/dspcs : ZIC1-123, /FLASH DSP : ZIC1-126, /DSPCS : DIC1-2, /DVD1CS : ZIC1-208, CSB : SIC1-10) 0 (Low) before trial.
So to speak, the bus is used by time-division as shown in Fig. 7-14.
Two and more devices can't be accessed simultaneously.

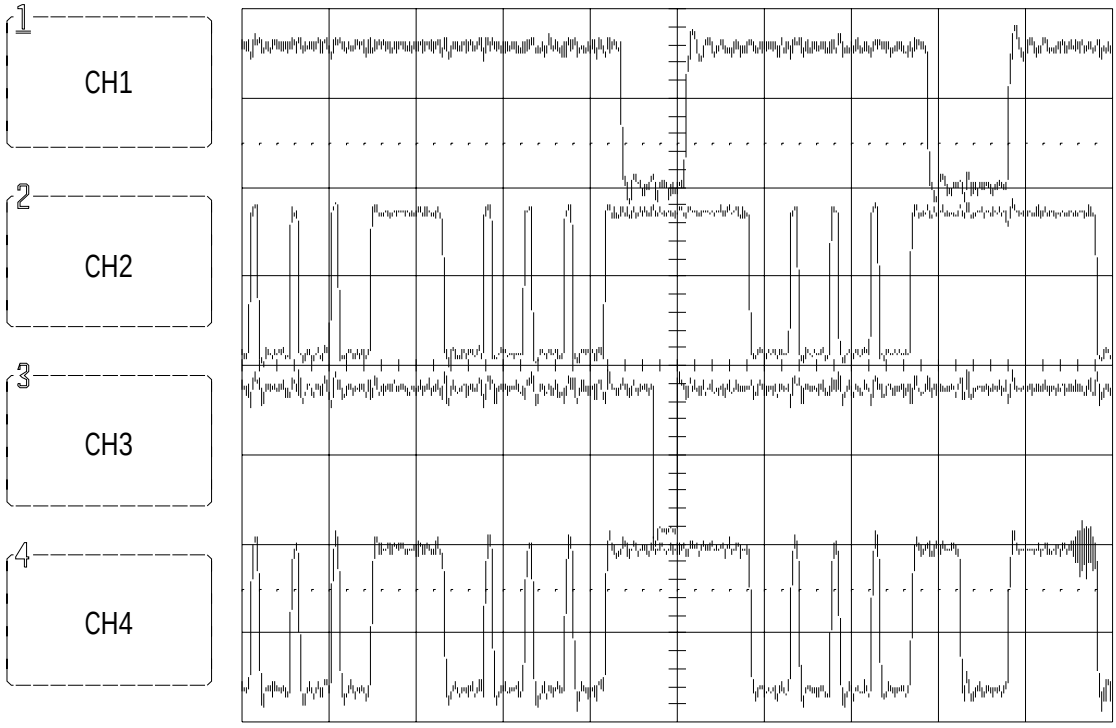

Fig. 7-14 Servo Chip Access

- CH1 : /DSPCS (ZIC1-123, DSP CHIP SELECT)
- CH2 : /FLASHCS (ZIC1-126, FLASH CHIP SELECT)
- CH3 : /WR 9ZIC1-129, MICOM OUTPUT WRITE SIGNAL)
- CH4 : /RD (ZIC1-128, MICOM OUTPUT READ SIGNAL)

7-4 Servo

7-4-1 Outline

SERVO system of DVD is Compoced of Focusing SERVO, Tracking SERVO, SLED Linked SERVO and CLV SERVO (DISC Motor Control SERVO).

1) Focusing SERVO : Focuses the optical spot output from object lens onto the disc surface. Maintains a uniform distance between object lens of Pick-up and disc (for surface vibration of disc).

2) Tracking SERVO : Make the object lens follow the disc track in use of tracking error signal (created from Pick-up).

3) SLED Linked SERVO : When the tracking actuator inclines outwardly as the object lens follows the track during play, the SLED motor moves slightly (and counteracts the incline).

4) CLV SERVO (DISC Motor Control SERVO) : Controls the disc motor to maintain a constant linear velocity (necessary for RF signal).

7-4-2 Block Diagram

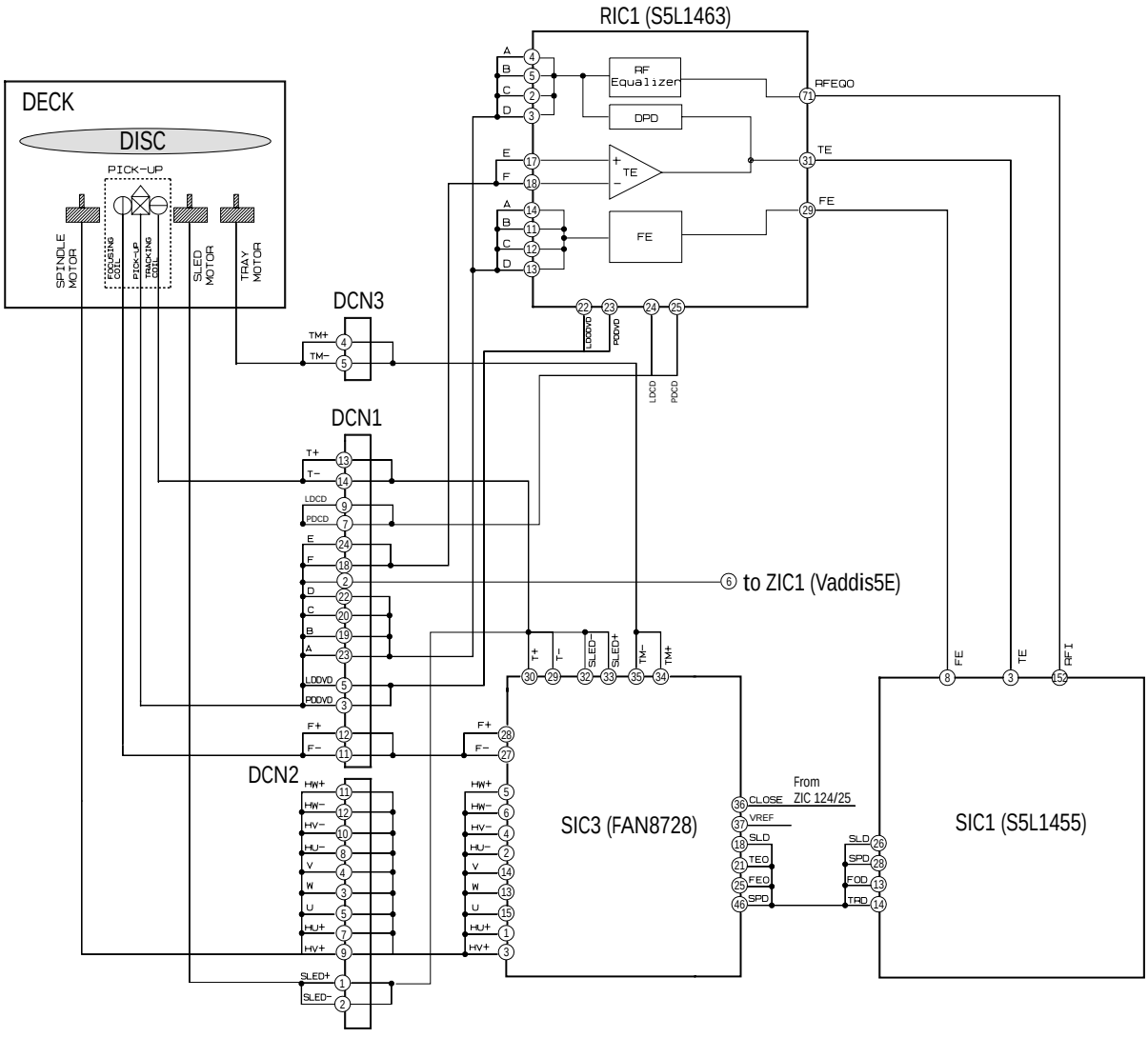

Fig. 7-15

7-4-3 Operation

1) FOCUSING SERVO

(1) FOCUS INPUT

The focus loop is changed from open loop to closed loop, and the triangular waveform moves the object lens up and down (at pin 13 of SIC1 during Focus SERVO ON.) At that time, S curve is input to pin 8 of SIC1.

ABCD (pin 34 of RIC1) signal, summing signal of PD A, B, C, D, is generated, and zero cross(1.65V) point occurs when S curve is focused and ABCD signal exceeds a preset,constant value. The focus loop is changed to closed loop, and the object lens follows the disc movement, maintaining a constant distance from the disc. (these operations are same in CD and DVD).

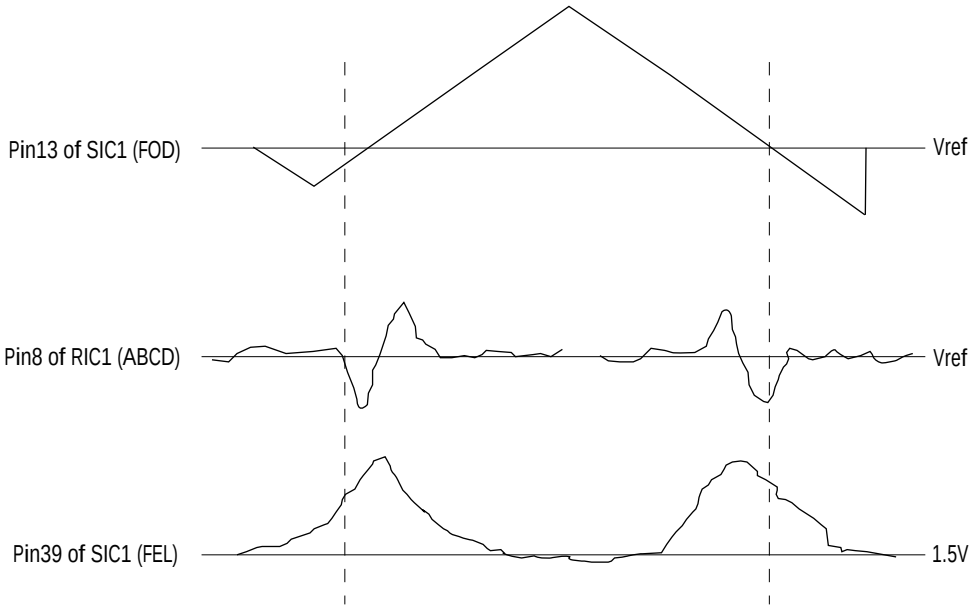

Fig. 7-16

(2) PLAY

When focus loop closes the loop during focus servo on, both pin 65 and pin 75 of SIC1 are controlled by VREF voltage (approx. 1.65V), and pin 26, 27 of SIC3 are approximately 2.5V.

2) TRACKING SERVO

(1) NORMAL PLAY MODE

❶ For DVD

Composite : The signal output from PD A, B, C, D of Pick-up, the tracking error signal (pin31 of RIC1) uses the phase difference of A+C and B+D in RIC1, and inputs to terminal 3 of SIC1. Then, it is output to SIC1 pin 14 via digital equalizer, and applied to the tracking actuator through SIC3.
Pin 14 of SIC1 is controlled by VREF(approx. 1.65V) during normal play.
Meanwhile, DVD repeats the track jump from 1 to 4 in inner direction at normal play (because data- read speed from disc is faster than data output speed on screen).

❷ For CD, VCD

Receive the signal output through E, F of Pick-up, from RIC1. The tracking error signal is similar to DVD.

(2) SEARCH Mode :

Search mode : Fine seek,(Moving the tracking actuator slightly little below 255 track) and coarse search, moving much in use of sled motor. The coarse search will be described in sled linked servo and now, the fine seek is explained shortly.
If the object lens is located near target, cut off the tracking loop and give the control signal as many as desired count to move the tracking actuator via SIC1 pin 14 terminal(TRD).

3) SLED LINKED SERVO

- Normal play mode
  Move SLED motor slightly by means of PWM signal in SIC1 pin 26, as the tracking actuator moves along with track during play. Control to move the entire Pick-up as the tracking actuator moves.

- Coarse serach mode
  In case of long-distance search (such as chapter serach), SIC1 uses MIRR and TZC signal of SIC1-37, 159.
  Then, read ID and compute the existing track count after input of next track.
  If the existing track count is within fine seek range, tracking begins using fine seek.

4) CLV SERVO(DISC MOTOR CONTROL SERVO)

Input RF signal (from Pick-up) to SIC1 pin 152.
Detect SYNC signal from RF in SIC1, and output PWM signal to SIC1 pin 28 for constant linear velocity.

7-5 DVD Data Processor

7-5-1 Outline

SIC1(S5L1455) performs Sync detection, EFM demodulation and error correction and Spindle motor control (CLV control) after inputting sliced EFM signal of RF signal at disc playback and EFM read clock (PLCK) signal generated from PLL. Outputs data which converted to the last audio and video from A/V decoder (ZIC1). SIC1 uses external memory(4M DRAM) as buffer as well as for error correction and carries out Variable Bit Rate transfer function. VBR function uses the external buffer as buffer to absorb the difference of transfer rate occurring because the transfer rate of disc playback is faster than data transfer rate demanded by A/V decoder (Video/Audio Signal Process Chip).
In case of general disc refresh, the memory is almost filled up periodically. It is because Write rate to memory after disc playback and signal process is faster than Read of A/V decoder. When the memory is filled, this status is reported by interrupt to main micom, which controls the servo to kick back the pick-up to the previous track after memorizing the last data read from disc until now. It takes some times to jump to the previous track and return to the original(jump location) again. The memory will have an empty space because A/V decoder reads out data of memory.
When the memory has an empty space, where data can be processed and written and the pick-up correctly gets to the original location(before kick back location) again, it reads data again avoids the interrupt of data read previously. The basic operation repeats to perform as described above.

7-5-2 Block Diagram

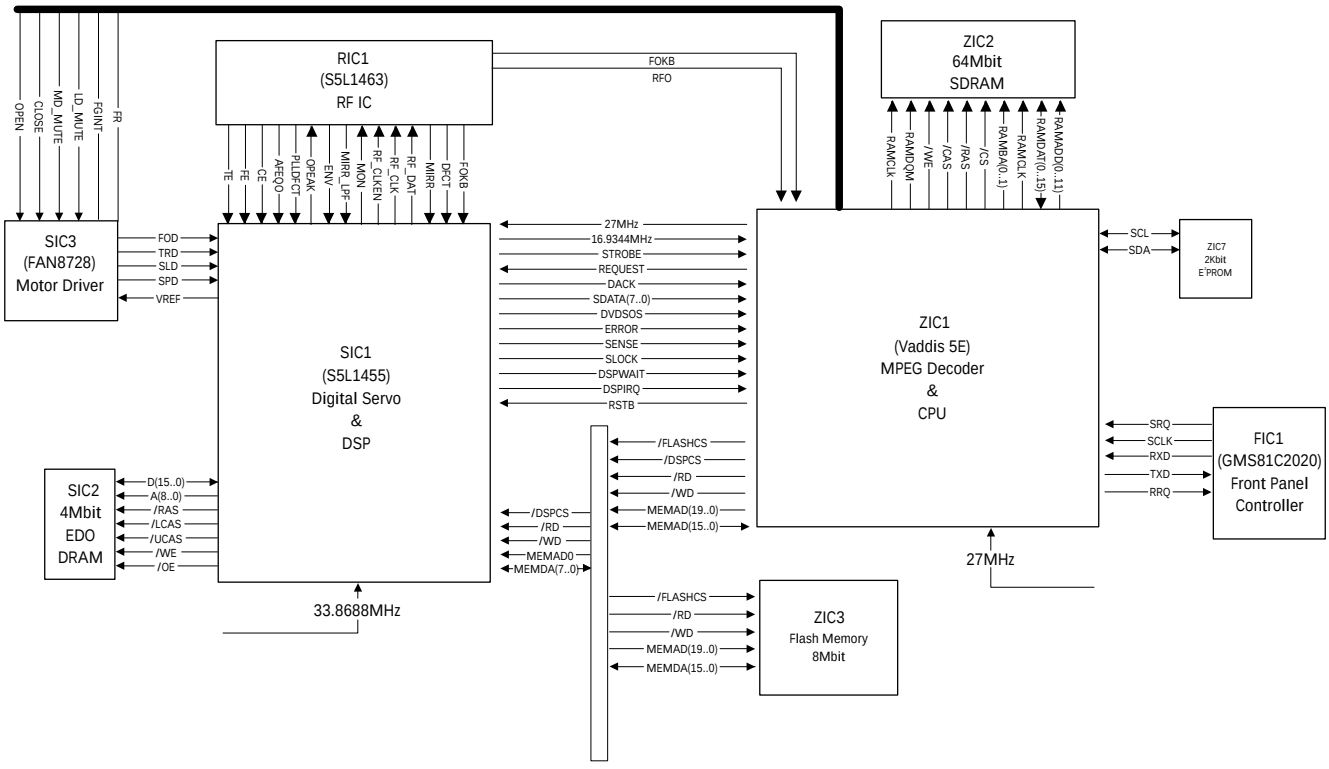

Fig. 7-17

7-5-3 Waveform Description

It measures the timing that data processed in SIC1 at DVD playback.

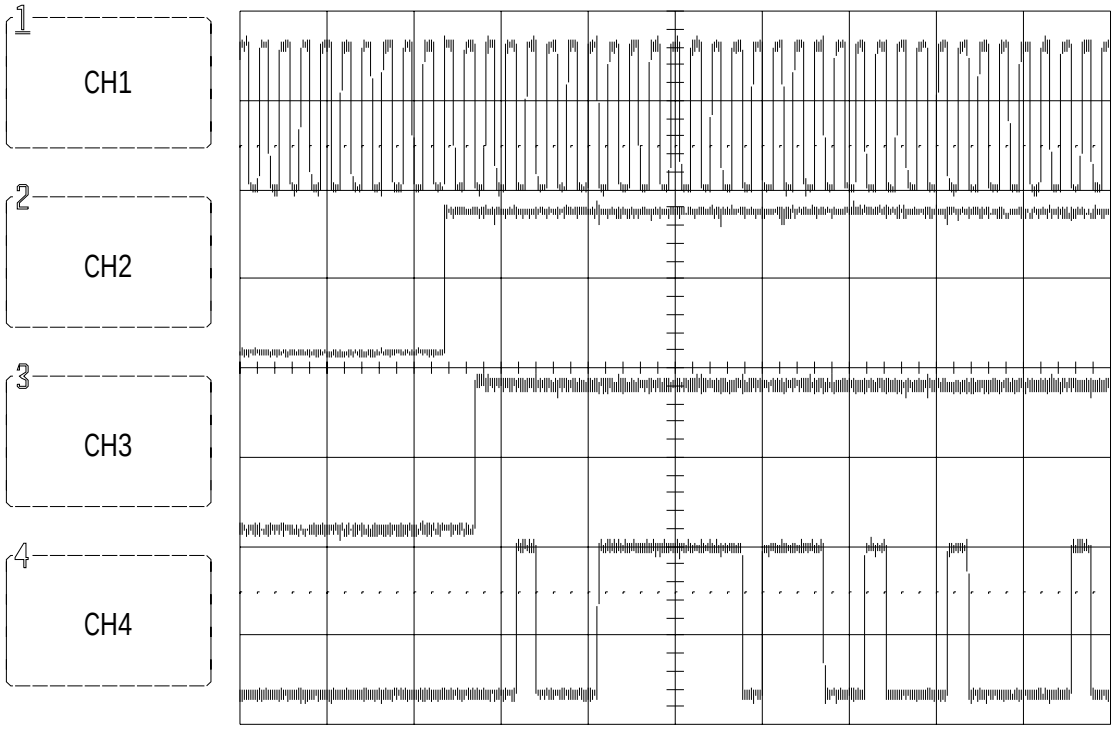

Fig. 7-18

- CH1 : STROBE (SIC1-123, CLOCK)
- CH2 : REQ (SIC1-124, DATA REQUEST)
- CH3 : DACK (SIC1-125, DATA ACKNOWLEDGE)
- CH4 : SDATA (SIC1-126~133, SDATA)

7-6 Video

7-6-1 Outline

ZIC1(A / V decoder with video encoder) diverges from the 27MHz crystal, then generates VSYNC and HSYNC.
ZIC1(A / V decoder with video encoder) does RGB encoding, copy guard processing and D / A conversion of 8bit video data internally inputted from video decoder block.
Video signal converted into analog signal is outputted via amplifier of analog part.

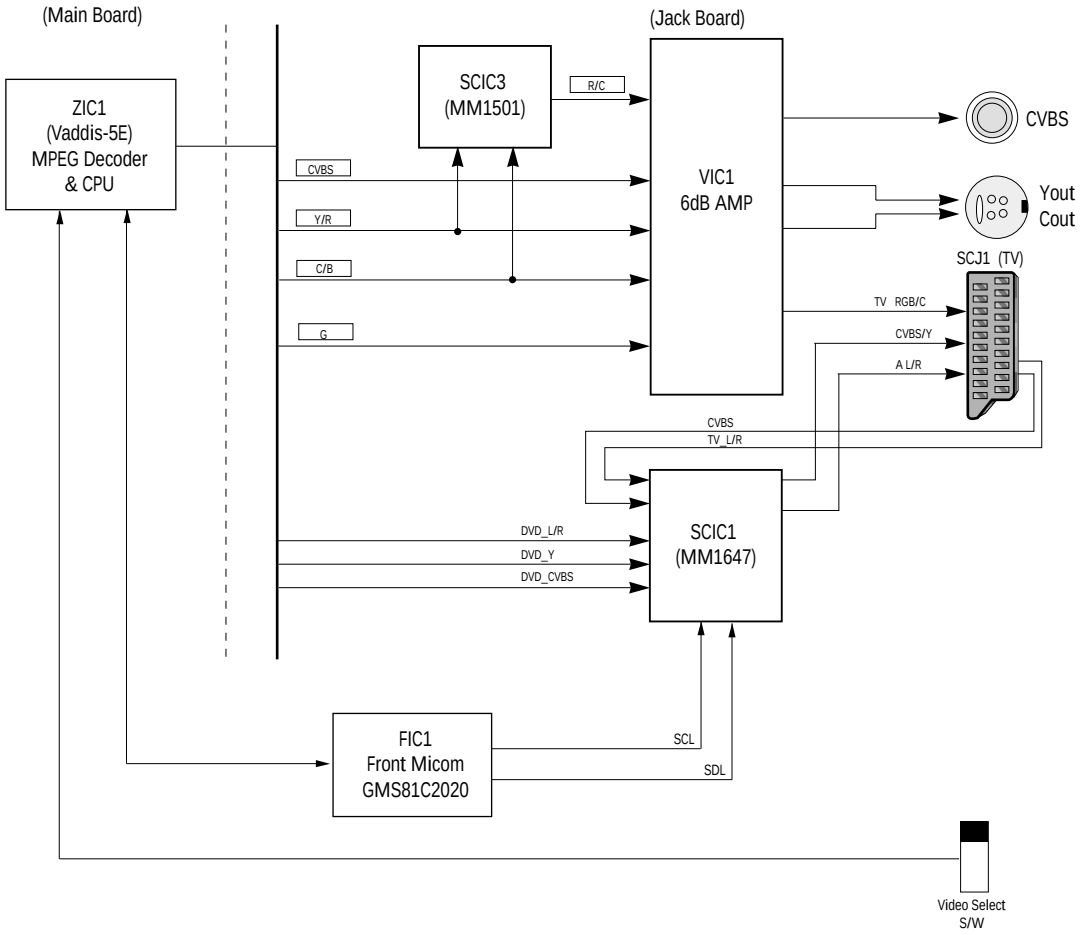

Fig. 7-19 Video Output Block Diagram

7-6-2 NTSC/PAL Digital Encoder (VADDIS 5E ; Built in video encode)

ZIC1 inputted from pin 161 with 27MHz generates HSYNC and VSYNC which are based on video signal.
ZIC1 is synchronous signals with decoded video signal and control the output timing of 8bit video signal of ITU-R601 format.
The separate signal is encoded to NTSC / PAL.
The above signals, which are CVBS (Composite Video Burst Synchronized), Y(S_VIDEO) / R(RED), C(S_VIDEO) / B(BLUE) and G(GREEN) are selectively outputted CVBS +S_VIDEO, RGB / Component by the rear switch. In Course of encoding, 8bit data can extend to 10bit or more.
To convert the extended data to quantization noise as possible, ZIC1 adopts 10bit D / A converter.
ZIC1 perform video en-coding as well as copy protection.

7-6-3 Amplifier (VIC1: LA73054)

VIC1 is 6dB amplifier.
Based on CVBS signal, the final output level must be 2Vpp without 75ohm terminal resitance.
Because the level of video encoder output is only 1.1Vpp, the level is adjusted with the special amplifier.
When mute of pin 5 is high active, if the pin is floating and connecte to power, the output signal is never ouputted.
CVBS, Y, C, R, G, B outputted from video encoder are inputted to VIC1 (Pin 2, 8, 6, 16, 11, 14).
The signal to which gain is adjusted by amplifier is outputted from jack via 75ohm Resistance (VR11~VR16).

7-7 Audio

7-7-1 Outline

A / V decoder (ZIC1 ; Vaddis 5E) is supply to DATA 0 for 2-channel mixed audio output.
The audio data transmitted from A / V decoder (ZIC1 ; Vaddis 5E) are converted into analog signal via audio D / A converter and outputted via post filter and amplifier.
CD and VCD are outputted with only 2 channels audio data and transmit them to Data 0.
If DVD of multichannel Source disc, if is downmixed and transmit them to Data0.
If you want to listen to the multichannel output, you have to connect digital output with AC-3 amp or MPEG / DTS amp.

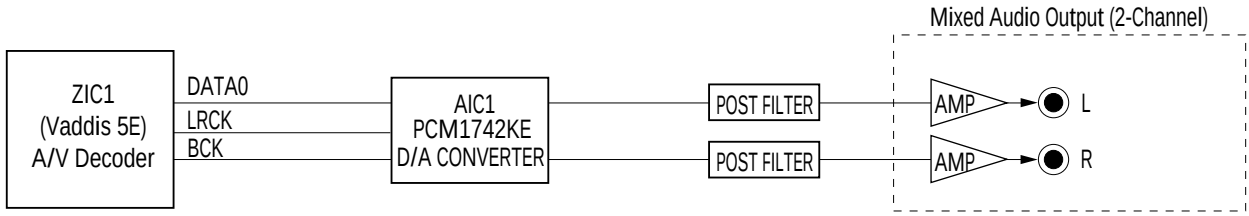

Fig. 7-20 Audio Output Block Diagram

7-7-2 DVD Audio Output

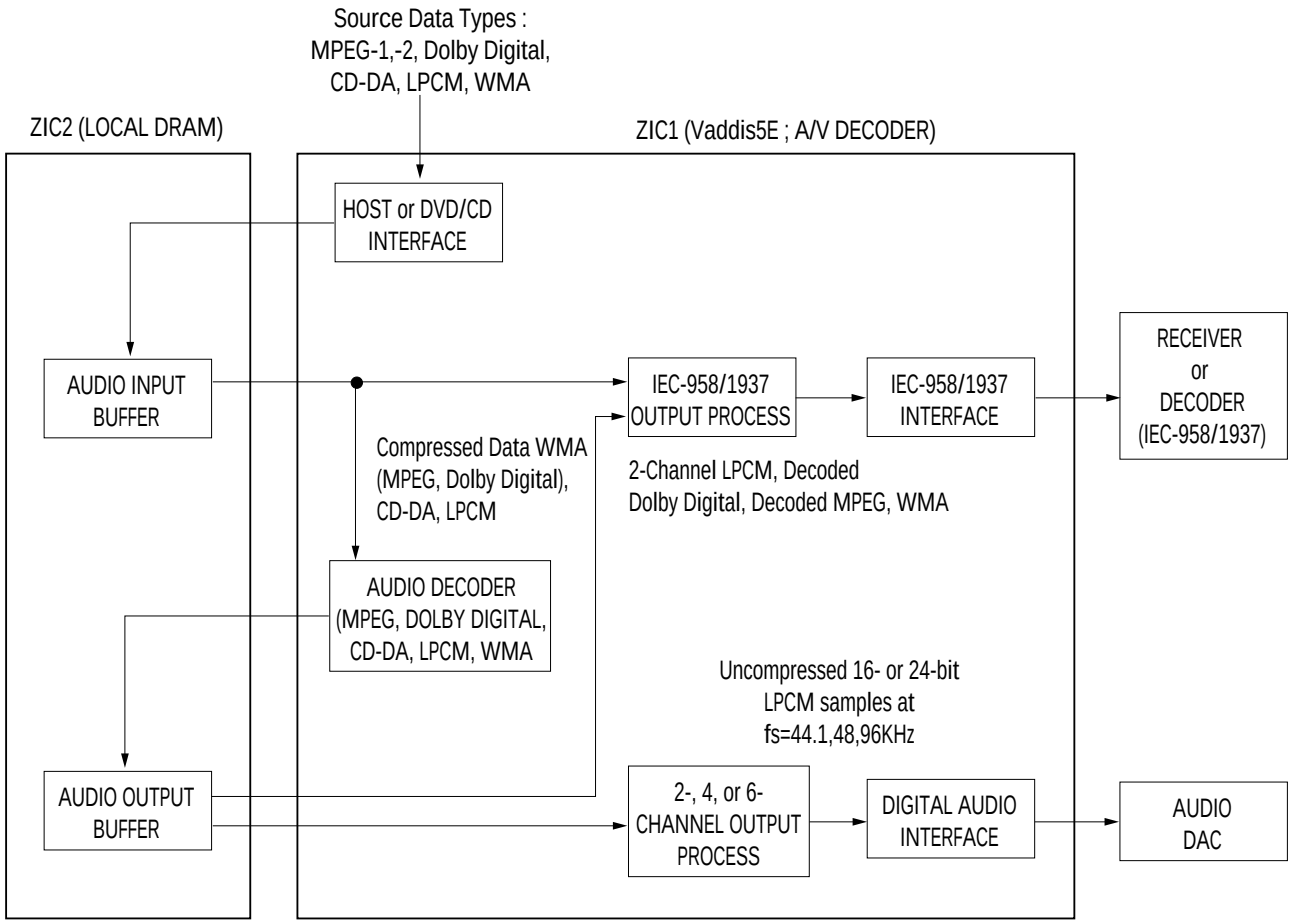

Fig. 7-21 Audio Decoder and Output Interface Datapath

1) Compressed Data

The audio data inputted to ZIC1 (Vaddis 5E) A/V decoder is divided into compressed data and uncompressed data.
It is compressed data that is compressed with multi-channel audio data such as Dolby digital, MPEG, DTS, WMA,etc. The compressed data inputted to ZIC1 (Vaddis 5E) is converted into the uncompressed data of 2, 4, and 6 channels through ZIC1 built-in audio decoder and is outputted to Data 0 through digital audio interface. The compressed data is transmitted to external AC-3 amplifier or MPEG/DTS amplifier as IEC-958/1937 transmission data format compressed by ZIC1 built-in IEC-958 output process.

2) Uncompressed Data

The uncompressed data is that data isn't compressed, so it is called CD-DA, LPCM data.
The 2 channels data is converted through audio decoder 2-channel data and Data 0 and are outputted in digital audio interface.Via IEC-958 output process, they is transmitted to digital amplifier or AC-3/MPEG/DTS amplifier built in the external digital input source with IEC-958/1937 transmission format.